

Designing and Implementing High-Speed 1394 Serial Bus in Desktop, Mobile, and Information Appliances

Name: Steven Schnier

Title: 1394 PC Market Segment Manager

Company: Texas Instruments



San Jose January 23-24, 2001



Taipei February 14-15, 2001

Agenda

- 1394 PC Market Summary
- Current 1394 Implementations per PC99
- 1394 and PC2001
- Future Considerations
- Call to Action

1394 Systems and Peripherals



Apple
HP
DELL
Compaq
Gateway
IBM

Sony
Toshiba
NEC
Fujitsu
Panasonic
Micron



Texas Instruments Silicon Solutions

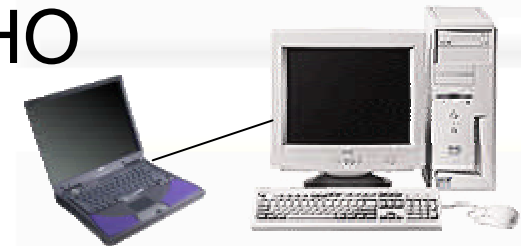
Why 1394 in the PC?



- Digital video editing
- High speed mass storage devices available today



- High quality 1394 desktop cameras enable new applications
- Networking via 1394 for SOHO environments
- High quality, Fast Printers and Scanners



Software support for 1394

- Win98
 - OHCI Bus Class Support
 - Desktop Camera Support
 - Camcorder support through TI DVConnect
 - Power management supported in HW
- Win98 Second Edition - Win98 Support Plus:
 - MSDV support for Camcorders (limited)
 - SBP-2 Update (for storage and scanners)
- Win2000 - Win98SE support plus:
 - 1394 HDD Boot and improved HDD performance
 - Printer/Scanner Support
 - Kernel DeBug over 1394
 - Service Packs TBD
- Millennium - Win98SE support plus:
 - 1394 HDD Boot
 - NDIS & IP over 1394
 - Kernel DeBug over 1394
 - Power Management for Storage and Idle Devices
 - Architecture for AV/C
 - Integrated Video Devices

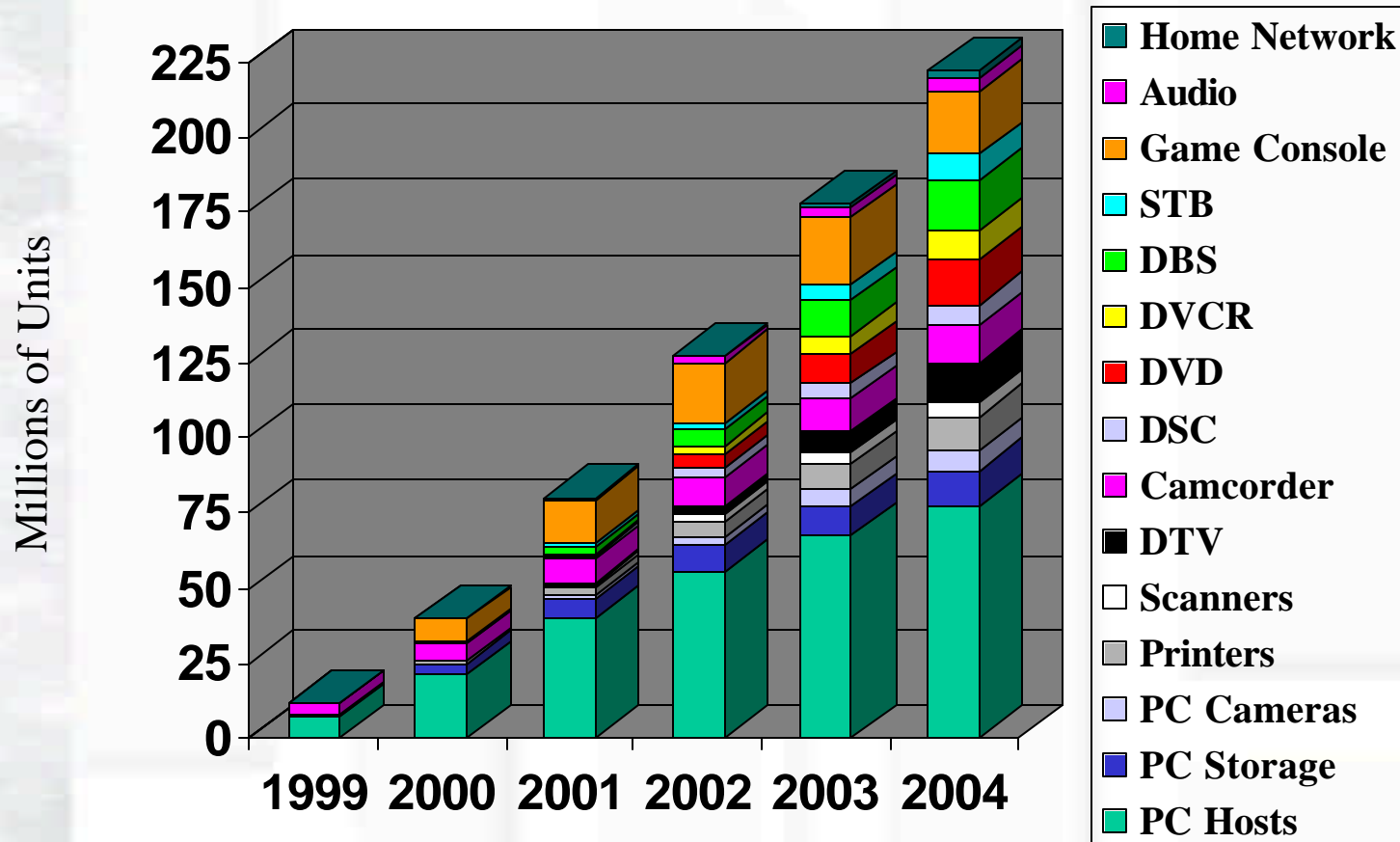
Plus support by 3rd parties for RTOS's

More Reasons for 1394...

- 1394 is the convergence point for the PC and consumer electronics
- Supports legacy reduction initiatives
 - Easy PC, Ease of Use
- 1394 is here NOW with 400 Mbps throughput, 1Gbit soon

1394 Adoption

At the Inflection Point

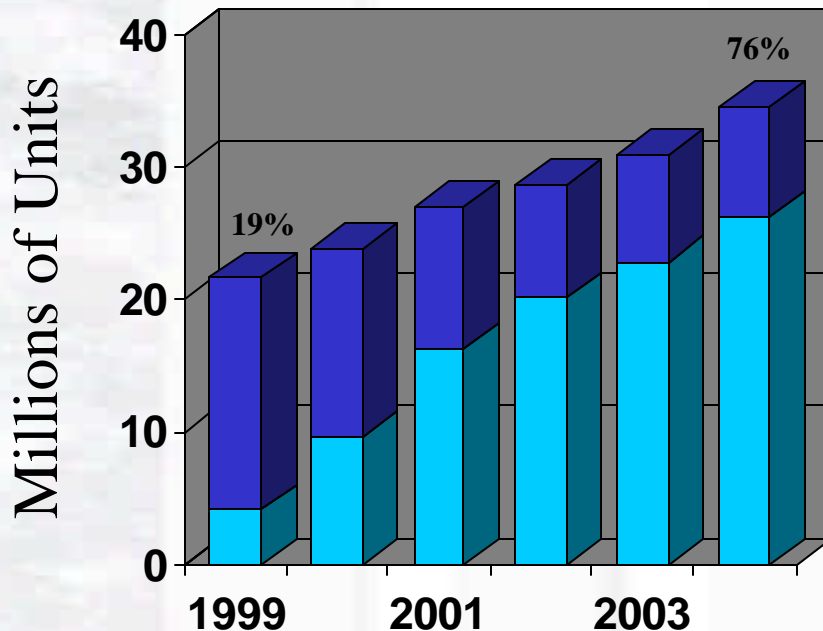


In-Stat, July 2000

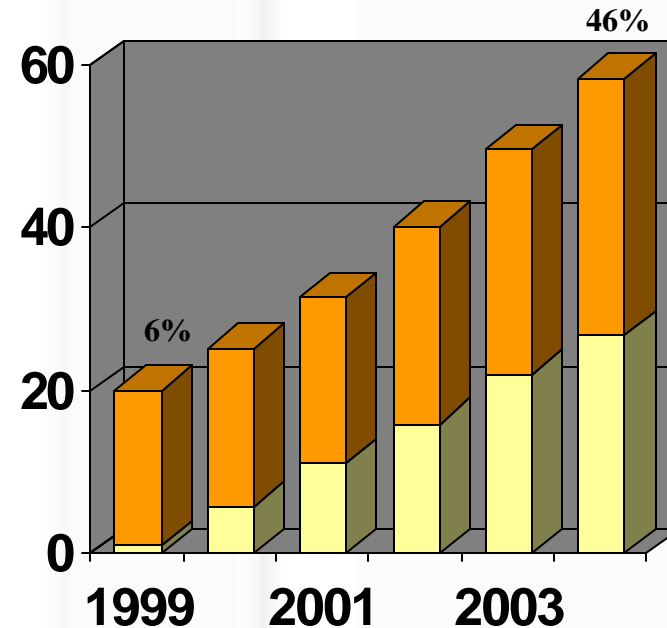
“The leader in the 1394 semiconductor market remains TI.”

- Mark Kirstein

1394 PC Adoption



■ 1394 Consumer ■ Total Consumer



■ 1394 Notebook ■ Total Notebook

Total 1394 PC Market Adoption

'00	'01	'02	'03	'04
16.6%	27%	32.8%	35.2%	35.5%

In-Stat, July 2000

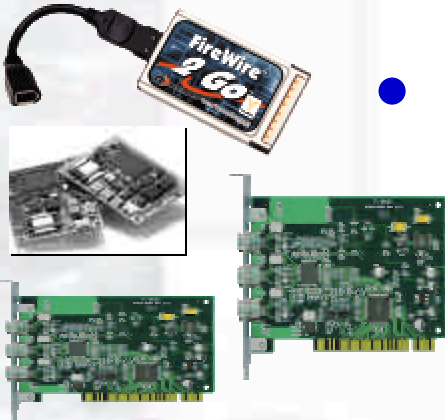
PC99 Implementation Choices

- Planar or adapter card?
- How many ports & where?
- Bus power options
- Hardware support for wake capabilities

Implementation



- Planar
 - Lowest cost
 - Easy to incorporate in design, or
 - Several off-the-shelf motherboards available



- PCI or Cardbus adapter
 - Many OEM choices available today
 - PCI options include PCI, LP PCI, mini-PCI, PC Card

Desktop Implementation of 1394

- On the Motherboard:
 - Discrete Link plus Phy (Most flexible design - port options)
 - Integrated Link plus Phy (Smallest OHCI+Phy Solution)
- Bundle Options
 - PCI Card (Offered as an option - Most expensive)



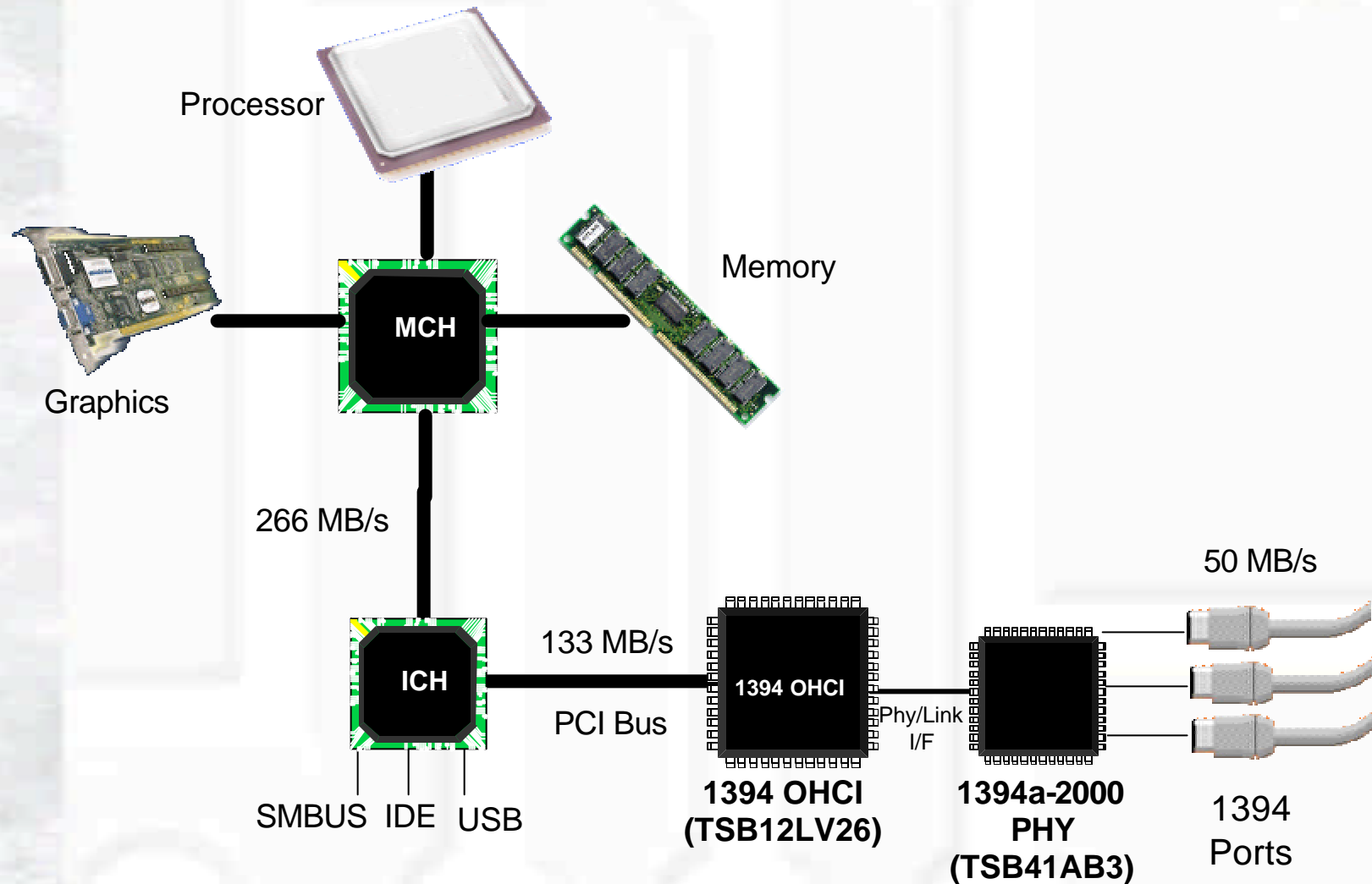
Motherboard, Discrete Link plus Phy shown

Mobile Implementation of 1394

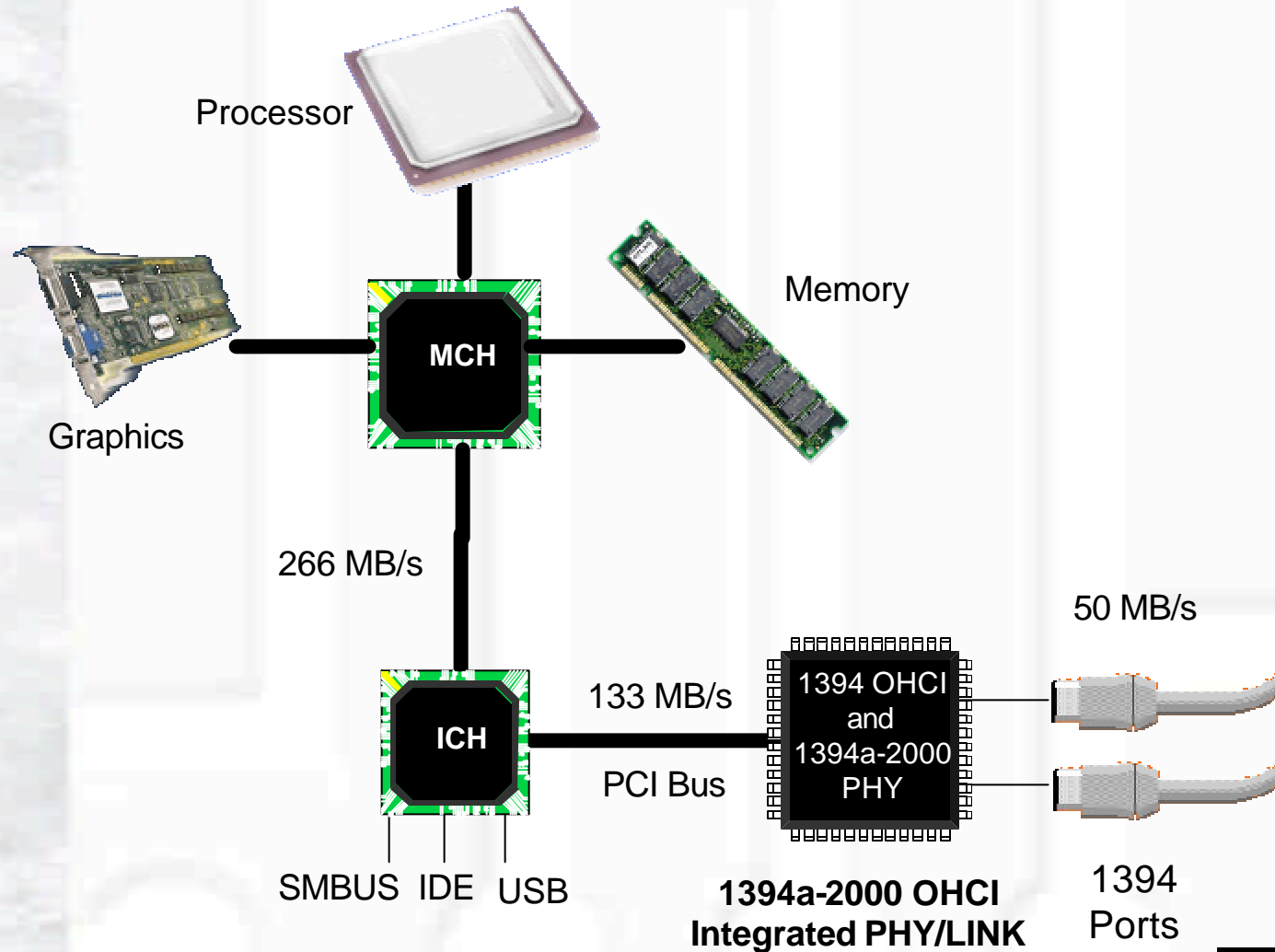
- On the Motherboard:
 - Discrete Link plus Phy (Most flexible design - # of ports)
 - Integrated Link plus Phy (Smallest OHCI+Phy Solution)
 - Integrated Cardbus/1394 (Small footprint - only add phy)
- Internal and External Options
 - Cardbus Card (Can be offered as an option - Most expensive)
 - Mini-PCI (Configurable - Discrete or Integrated, # of ports)



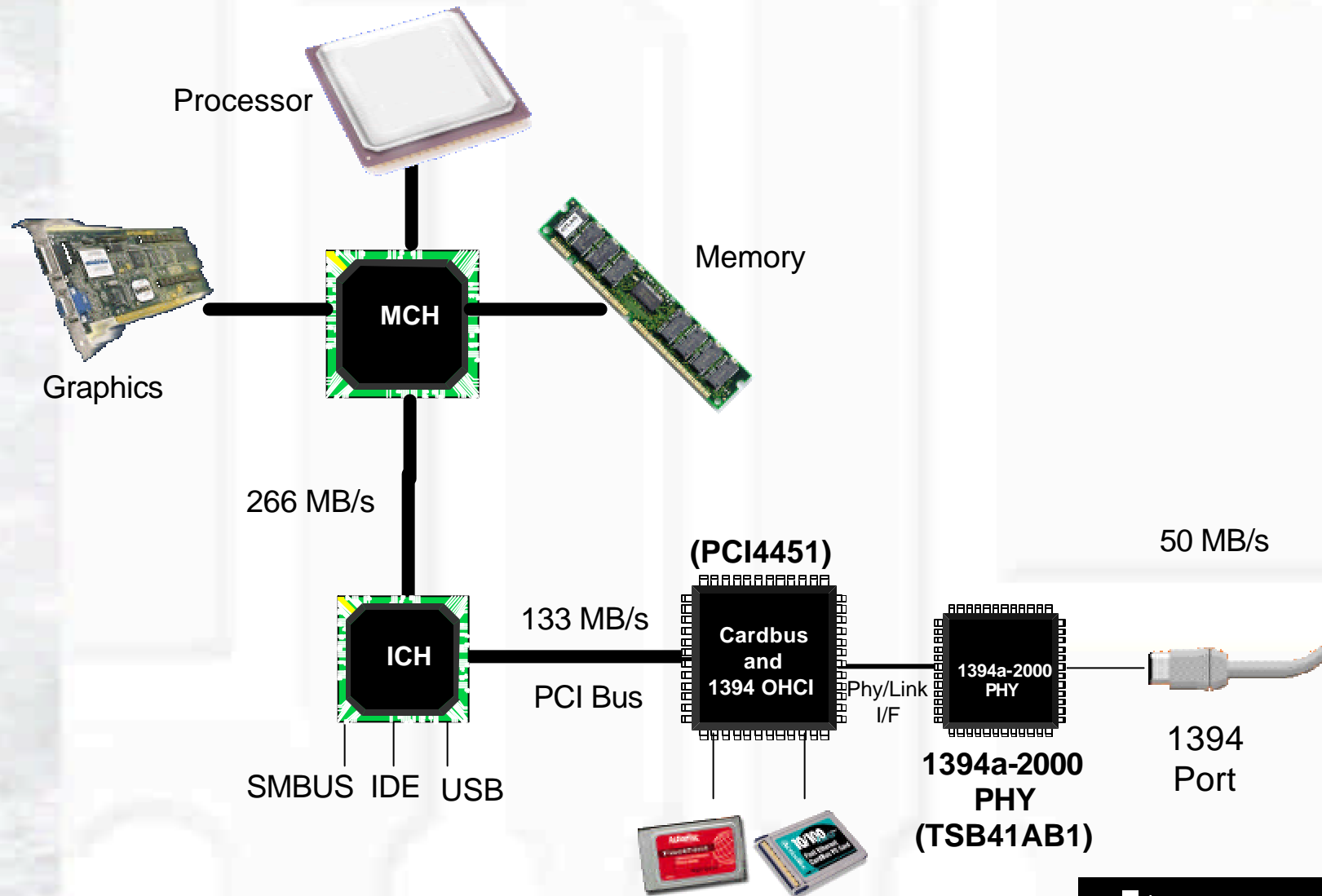
Example Desktop PC99 Implementation



Example Desktop/Mobile PC99 Implementation



Example Mobile/SFF PC99 Implementation



Port Configurations

- Two ports minimum per PC99
 - Two ports required for desktops supporting 1394
 - Three (or more) ports is better
 - Capable of branching
 - Best bus BW utilization
 - One port allowed for mobile platforms, appliances
- Front ports recommended for ease of use
 - Allows easy connection for consumer electronics, etc.
 - Routing must be carefully considered
 - Cables can be used but must be cautious of input impedance requirements of 1394-1995 4.2.2.5

Bus Power Requirements

- A 1394 enabled PC shall source bus power
 - PC99 8.34
 - Typically provided via 12V
 - Can be taken directly from PCI 12V
 - 500 mA PCI requirement limits 1394 bus power
 - Not an option for mini-PCI implementations
 - Can be supplied via power connector to PS
 - Provides more available 1394 bus power, but impacts PS budget
 - Mobile platforms are exempt from power sourcing
- PC99 8.27 implies six pin connector requirement
 - Required to provide or repeat power
- Physical layer should be powered at all times
 - Bus powered
 - 3.3Vaux power

1394 Host Power Management

- PCI PM 1.1 required for PCI devices
 - PME# supports wake capabilities
- 1394a-2000 phy-link interface specifies LINKON mechanism for wake events via 1394
 - Can be generated via linkon packet or port events (connection status change or resume events)
 - 1394 OHCI may generate PME# from LINKON
- Vaux implications
 - Physical layer must be bus powered or aux powered
 - 1394 OHCI link layer must be aux powered for D3 wake ups
 - May require discrete power on reset

What's New for PC2001

- OHCI 1.1
 - Improved power management (ack_tardy), dual buffer mode, etc.
- 1394a-2000 required for external connection
- P1394b optional
 - External ports must be 1394a-2000 or bi-lingual
 - Beta mode ports acceptable for internal ports

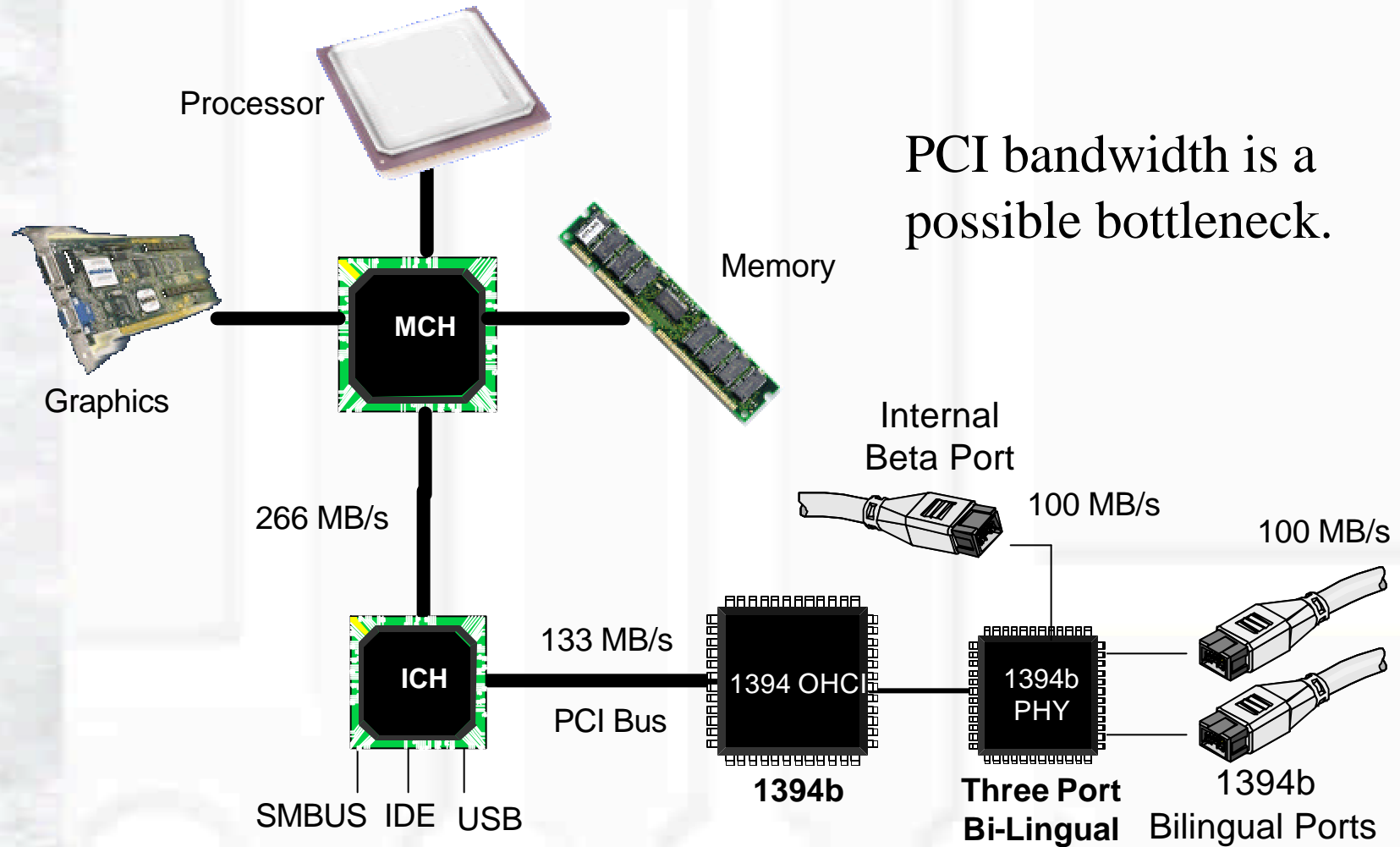
Implementation Choices

- External ports for walkup connectivity
 - Expect most peripherals to be 1394a-2000 for several years
- Internal ports for storage
 - May be P1394b or 1394a-2000

Gigabit 1394 and Beyond

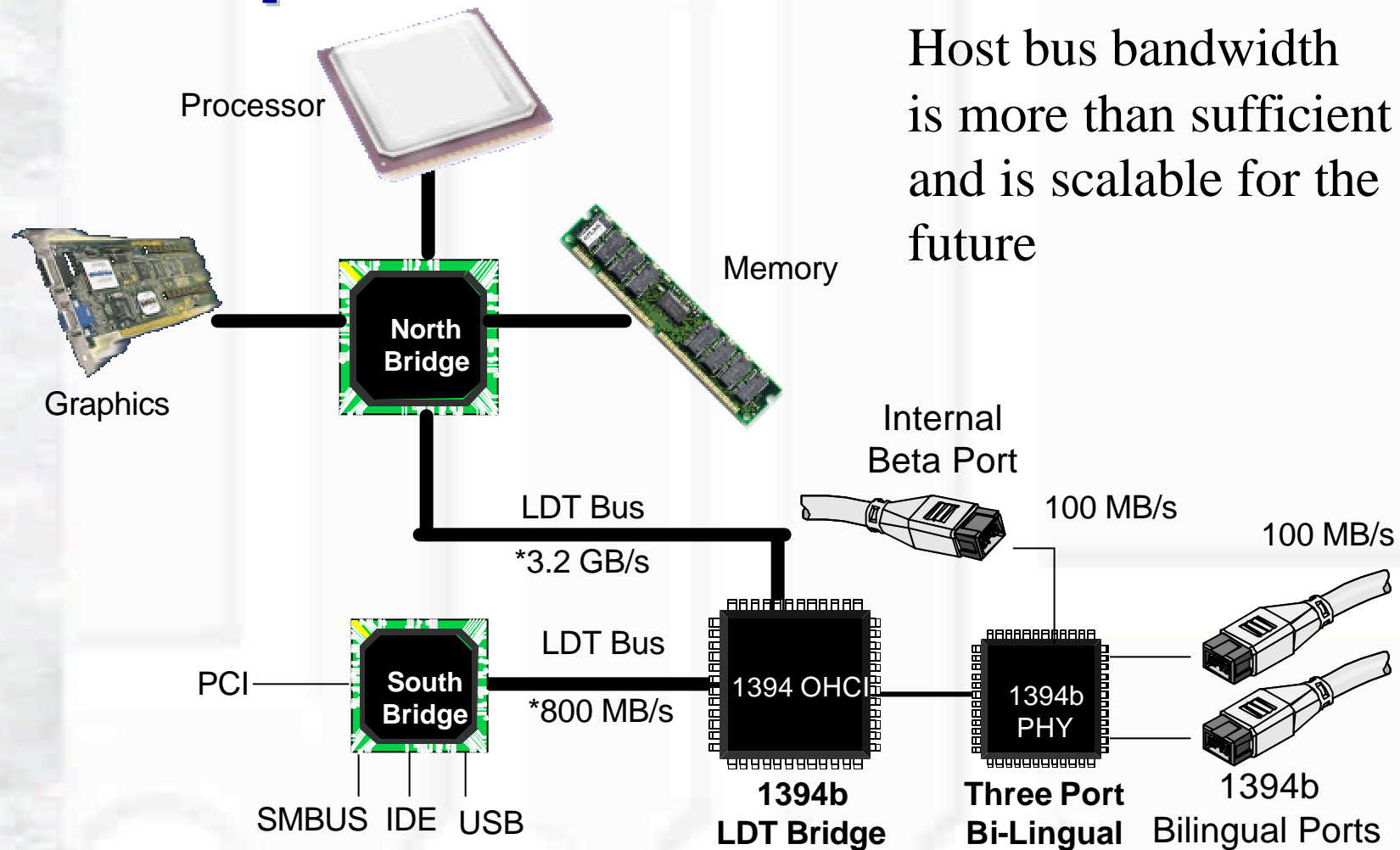
- S800 1394b ~ 100 MB/s
 - 32/33 PCI 133 MB/s max
 - S800 possible on 32/33 PCI but may limit performance
- 64 bit, 66 MHz PCI, or PCI-X
 - Not ubiquitous in consumer segment
- LDT
 - May provide a good solution for more host bus bandwidth for 1394 on AMD based platforms

Example 1394b Implementation



PCI bandwidth is a possible bottleneck.

Example LDT 1394b Solution



Host bus bandwidth
is more than sufficient
and is scalable for the
future

*Assumes 16-bit (each way) host interface
and 4-bit (each way) peripheral bridge interface

Call To Action

- Take advantage of the value added features of 1394
 - Add 1394 to your PC SKUs
- Evaluate 1394b platform requirements now
- Work with the 1394 TA to evangelize the benefits of 1394
- Work with TI for your 1394 Solutions (www.ti.com/sc/1394)

TI 1394 Options for Mobile

Motherboard



Integrated Cardbus/1394 (Small footprint - only add phy)

- PCI4450/51 - Dual Slot Cardbus controller plus OHCI 1394a Link
- PCI4410 - Single Slot Cardbus controller plus OHCI 1394a Link

Discrete Link plus Phy (Most flexible design - # of ports)

- Link: TSB12LV26 - 3rd generation OHCI 1.0 1394a Link
- Link: TSB42AD2 - 4th generation OHCI 1.1 1394a Link
- Phy: TSB41ABx - 1, 2, 3-port - 400Mbps, low power, 1394a phys

Integrated Link plus Phy (Smallest OHCI+Phy Solution)

- TSB43AA22 - OHCI 1.0 1394a Link and 400Mbps 2-port
- TSB43AB22 - OHCI 1.1 1394a Link and 400Mbps 2-port

PC Card



Discrete Link plus Phy (Supports both PCI or CardBus)

- Link: TSB12LV23 - 2nd OHCI 1.0 1394a Link (PCI or CardBus)
- Phy: TSB41ABx - 1, 2-port - 400Mbps, low power, 1394a phys

Mini-PCI



Discrete Link plus Phy (Most flexible design - # of ports)

- Link: TSB12LV26 - 3rd generation OHCI 1.0 1394a Link
- Link: TSB42AD2 - 4th generation OHCI 1.1 1394a Link
- Phy: TSB41ABx - 1, 2, 3-port - 400Mbps, low power, 1394a phys

Integrated Link plus Phy (Smallest OHCI+Phy Solution)

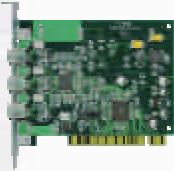
- TSB43AA22 - OHCI 1.0 1394a Link and 400Mbps 2-port
- TSB43AB22 - OHCI 1.1 1394a Link and 400Mbps 2-port

TI 1394 Options for Desktop/SFF

Motherboard



PCI Add-in Card



Low-Profile Add-in Card



Discrete Link plus Phy

(Most flexible design - # of ports)

- Link: TSB12LV26 - 3rd generation OHCI 1.0 1394a Link
- Link: TSB42AD2 - 4th generation OHCI 1.1 1394a Link
- Phy: TSB41ABx - 1, 2, 3, 4 or 6-port - 400Mbps, low power, 1394a phys

Integrated Link plus Phy

(Smallest OHCI+Phy Solution)

- TSB43AA22 - OHCI 1.0 1394a Link and 400Mbps 2-port
- TSB43AB22 - OHCI 1.1 1394a Link and 400Mbps 2-port
- TSB43AB23 - OHCI 1.1 1394a Link and 400Mbps 3-port

Who is using TI 1394 in Desktops or Notebooks?

- Compaq
- Dell
- Hewlett-Packard
- IBM
- Gateway
- Apple
- Sony
- Fujitsu
- Panasonic
- And Most Off-the-Shelf 1394 Adapter Cards:
 - ADS Tech, Dazzle, Pinnacle, SIIG, Digital Research, Apple, etc.



Market leader: the TI advantage

- Mature designs in volume production
 - Greater than 85% market share in computer market
 - Greater than 70% market share in camcorder market
 - Shipped over 57 million links and phys to date
 - More than 6 years experience in shipping 1394 solutions
 - Proven reliability, compliance, compatibility and interoperability

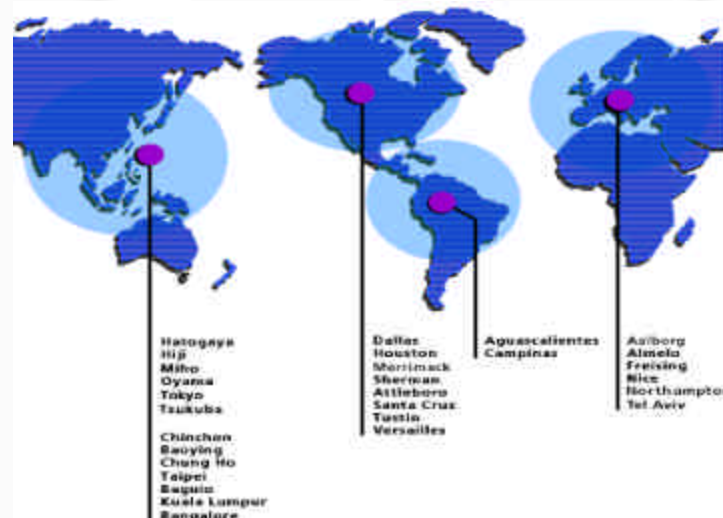
“The leader in the 1394 semiconductor market remains Texas Instruments” In-Stat June 2000

Why is TI the leader?

- Superior Product Offering
 - Proven Silicon, Shipping in Volume (Since 1994!)
 - 3rd Generation OHCI and PHY Silicon
 - Best Performance and Lowest Power
 - Package Options - ? *BGA, LQFP, TQFP, HTQFP
 - Lead free solutions for over six years
 - Compatibility Proven With Real Devices
 - Supplier of 1394 to Both Ends of the Cable
 - PC, PC Peripheral, Consumer Electronics
 - Extensive Technology Roadmap
- Unparalleled Worldwide Application Support

Design support: the TI advantage

- Worldwide Presence
 - Local applications, marketing, and sales support across the globe (APR, Europe, Japan, USA)
- Worldwide Manufacturing Capacity



Complete Application Support

- ✍ Worldwide 1394 Application Engineering Teams
- ✍ Reference Designs - Motherboard, Add-in, Mobile
- ✍ Application Notes - Crystal Selection, PHY Layout, EMI Reduction, OHCI Configuration, 1394a PHY Features, Events on TP Lines, Transition Documents
- ✍ Schematic and Layout Review - Take advantage of it
- ✍ Functional & Compatibility Testing - Complete test reports returned
- ✍ Evaluation and Debug
- ✍ Production Software - OHCI-ROM, TI-ECHO, and Lynxtest
- ✍ Application Software - DVConnect, DV Suite, Camera Drivers



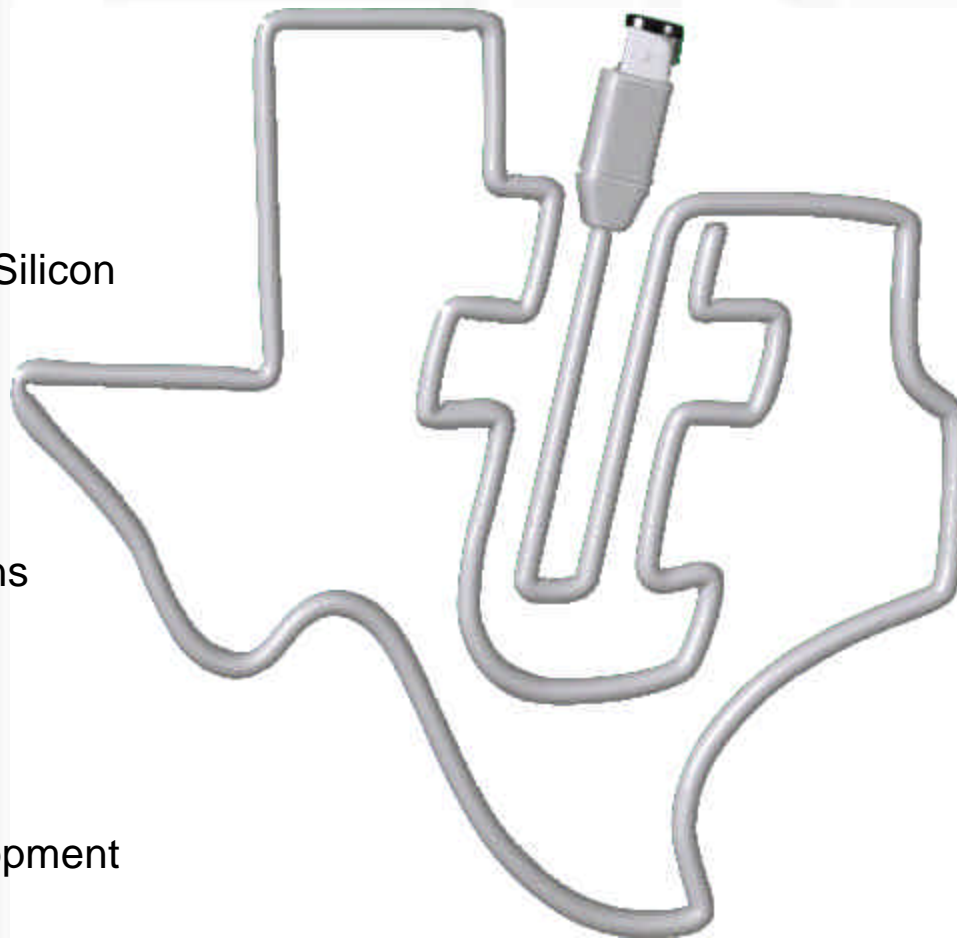
Industry Leading Silicon



Complete Applications
Support



Software Development
Team



WW 1394 Support Team



<http://www.ti.com/sc/1394>



Designer Kits

1394 AND TI

THE SHAPE OF THINGS TODAY!